ACOSAR – specifying an open interface for system integration

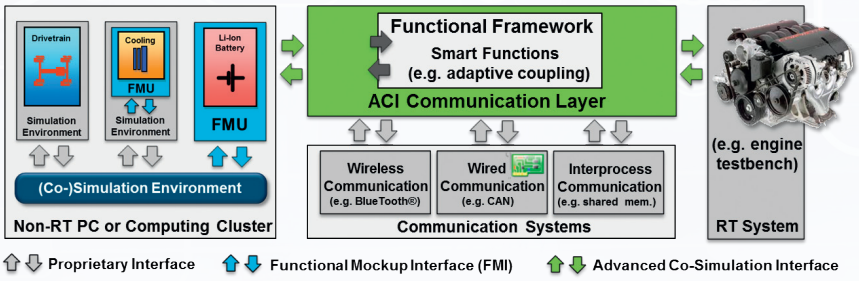
Simulation frameworks are commonly used in industry to assess specific components, providing an efficient and effective method for development and testing. We spoke to **Martin Benedikt** about the ACOSAR project's work in developing an interface to integrate real-systems, work which holds important implications for the transport sector in particular

Many companies use virtual systems and simulation frameworks during development, allowing staff to assess specific components more efficiently and in the long-term bring new products to market faster. However, integrating real-time (RT) systems like HiL (hardware in the loop) test-beds with simulation frameworks remains a complex task, an issue that the ACOSAR project aims to address. "We aim to develop an Advanced Co-simulation Interface (ACI) to methodologically integrate these real-time systems," says Martin Benedikt, the project's leader. Currently the integration process is quite intensive and error-prone, as configuring the communication protocols and the overall system requires a lot of work; Benedikt and his colleagues aim to develop a more efficient approach. "This is a major part of the motivation behind the project, to reduce configuration complexity and related effort," he outlines.

Automotive industry

This research holds important implications for the automotive industry in particular, in which vehicles are growing ever more complex, at the same time as budgets are being squeezed. There are of course many complex individual components in a vehicle, and they are typically developed in different locations before the car is eventually brought together and reaches the market. "With the automotive pathway, we have an engine running in a specific test-bed, a gear-box is virtually running in a specific 3rd party simulation tool, we have a battery system running on a remotely located test-bed. The idea is to define the interfaces between these different components," he explains. "Once we have data on all the different components from multiple components, we can look to simulate the transient interactions and dynamics of the vehicle itself. This could be done with modular and (soft) real-time capable co-simulation approaches."

To enable effective and efficient RT-System integration, ACOSAR will provide innovations on different levels:



A wide variety of components need to be assessed during the development process, and the number is set to increase further as the prospect of autonomous vehicles being widely used on the roads moves ever closer. Alongside established components like the engine and the gear-box, manufacturers also increasingly need to consider technologies like sensors, cameras and control systems. "Car manufacturers want to integrate different components, so we need to know the determinants of those components," says Benedikt. A more efficient method of sharing information takes on clear importance in this context, allowing car manufacturers and their suppliers to work together more easily during development, and to identify any potential issues at an earlier stage. "We can seamlessly integrate components into simulation environments," he outlines.

This could lead to improvements in test efficiency, helping to accelerate the system development process and enabling new business models. There are still some major technical challenges to overcome however, particularly in terms of the communication protocols used in integrating these components. "A lot of different communication protocols were used to interlink the different components. In order to develop a standardised method of data exchange, we have to extract these communication protocols, and to learn more

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about their underlying nature," he explains. Researchers in the project aim to specify an additional communication protocol which will work alongside existing protocols, helping to improve the efficiency of tests and simulations. "We aim to specify an additional communication protocol on top of existing protocols," continues Benedikt.

The project consortium brings together a number of partners from both the academic and commercial sectors to pursue this work, testament to the wider industrial relevance of this research and the level of interest in it. Along with major transport companies, the consortium also includes some original equipment manufacturers (OEMs); Benedikt says this collaboration will help ensure the project's work is relevant to practical problems, in particular the technical and economic challenges facing industry. "A lot of work is being done on the ACI Specification, and this is being fed in by companies on different sides of the automotive domain. They will add context to each other's work during development, during the course of the project, and help to spread knowledge and expertise to other participants," he says.

Project consortium

This research holds important implications for the car industry, yet its relevance is not limited solely to the automotive domain. Alongside car companies, Benedikt says the project's research could also bring benefits in other areas of the transport industry looking to improve system development processes. "For example, many systems also need to be integrated in the aviation domain," he points out. The project is working towards three key outcomes in terms of the wider applicability of their research. "The first is the classification, where we evaluate the specification of this interface, we want to embed it into an existing standard," he outlines. "The second is a methodology to support the integration of systems. The third outcome is to establish a community, which supports our research after the project."

Researchers plan to collaborate with other industries on areas of common interest, while work will also continue on specification and the integration of the project's findings with existing standards. This is a technically complex area, and researchers are in discussions with standardisation organisations, including Modelica Association and ASAM e.V.. "We're looking at how we can extend existing standards, as well as how we can establish new ones," he outlines. As the project progresses, Benedikt and his colleagues are looking towards demonstrating the project's findings and publicising their research. "Over the latter part of this year we want to have a public demonstration of the standard. Along with this, we also aim to attract further industrial partners at a user event, where we invite other vendors, improve our ideas and get further feedback from other industries," he says.

This could in the long-term lead to a more economical development process, potentially opening up the market to new entrants and leading to the emergence of new business models. The impact of this may eventually trickle down to consumers in the form of lower prices, something we would probably all welcome!

Modular, open system architectures for virtual design to integrated tests with real components

At a glance

Full Project Title

Advanced Co-simulation Open System ARchitecture (ACOSAR)

Project Objectives

The ITEA 3 ACOSAR project will enable effective and efficient Real Time (RT)-System integration through a modular co-simulation approach that supports flexible system development to facilitate an efficient system development process and create new business models.

Differentiation to FMI and added value:

- Distributed Co-Simulation by integrating tools
- Interactive Co-Simulation without model export
- Integration of (multiple) testbeds and simulations

Project Partners

AVL List GmbH • Robert Bosch GmbH • dSPACE GmbH • ETAS GmbH • Ilmenau University of Technology • ESI ITI GmbH • Leibniz University of Hannover • ks.MicroNova GmbH • Spath MicroElectronicDesign GmbH • Dr. Ing. h.c. F. Porsche AG • Renault SAS • RWTH Aachen University • Siemens Industry Software SAS • TWT GmbH Science & Innovation • Virtual Vehicle Research Center • Volkswagen AG

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Dr Martin Benedikt is team leader of the group 'Co-Simulation & Software' at the VIRTUAL VEHICLE Research Center and received his Ph.D. degree in Control Engineering from Graz University of Technology in 2013. His main research interests include control system design, system modelling and holistic system simulation.

ACOSAR
ADVANCED CO-SIMULATION OPEN SYSTEM ARCHITECTURE

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